A reappraisal of the vital effect in benthic foraminifera on Mg/Ca ratios: species specific uncertainty relationships

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Résumé en anglais	The reconstruction of past temperatures is often achieved through measuring the Mg/Ca value of foraminiferal test carbonate. The diversity in foraminiferal Mg/Ca-temperature calibrations suggests that there is also a biological control on this proxy. This study presents a new Mg/Ca-temperature calibration for the benthic foraminifer Bulimina marginata, based on cultures under a range of temperatures (4-14 ° C). Measured Mg/Ca values for B. marginata correlate well with temperature (Mg/Ca = 1.10 ± 0.10e0.045 ± 0.009T, R2=0.28, p<0.01). The inter-individual variability is, however, also significant (standard deviation is 10-35 % of the average). Before applying this or any calibration, the effect of the inter-individual variability on the accuracy of the Mg/Ca-temperature calibration has to be evaluated. The inter-individual variability is quantified and split in three components, namely (1) an analytical error; (2) an environmental effect and (3) a vital effect. The effect of inter-individual variability on the accuracy of Mg/Ca-temperature calibrations is depending on the sensitivity of the used calibration and the number of individuals measured (Temperature uncertainty = (0.33 · N-0.50)/sensitivity). The less sensitive a calibration, the greater is the impact of inter-individual variability. This can partly be circumvented by measuring more individuals. Differences in sensitivity may depend on the stability of the environment in which the foraminifera live and the concurring ecological strategy. This study shows the link between inter-individual variability en sensitivity and their influence on the accuracy of Mg/Ca-temperature calibrations.
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